Patent Application of

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For

TITLE: Safe Auto-Locking Belay Override Mechanism

CROSS-REFERENCE TO RELATED APPLICATIONS

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STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH AND DEVELOPMENT

Not applicable.

BACKGROUND - - FIELD OF INVENTION

This invention pertains to an auto-locking belay safety mechanism which improves the safety characteristics of an auto-locking belay device. In particular, it pertains to a mechanism that will cause a rope to be locked against passage through an auto-locking belay device even if the belayer panics after having overridden the locking mechanism within the auto-locking belay device.

BACKGROUND - - DESCRIPTION OF PRIOR ART

In the sport of rock climbing, a belay device is used to protect a climber. The person operating the belay device is known as the belayer. A climbing rope, one end of which is attached to the climber, runs through the belay device which is anchored near, or attached directly to the harness of, the belayer. The belayer can control the rate of movement of rope through the belay device and, if the climber falls, the belayer can stop the rope using the belay device, thereby stopping the fall of the climber.

There is a class of belay devices known as auto-locking belay devices. Such devices need no action on the part of the belayer to stop the rope in the event of a fall by the climber. If a climber falls, the forces of the rope on an auto-locking belay device cause the belay device to lock the rope. Unfortunately, these devices also tend to lock the rope when a belayer attempts to quickly feed rope out to the climber. This is because the act of feeding rope rapidly through the device yields approximately the same rope forces on the belay device as those experienced when a climber falls. The belayer, therefore, often has to temporarily override the normal function of an auto-locking belay device in order to rapidly feed rope through the device to the climber. Auto-locking belay devices therefore contain a means to override the normal function of the device. If a climber falls when the belayer has overridden the normal function of an auto-locking belay device, the belayer should release his hold on the device, thereby canceling the override function and allowing the belay device to function normally so as to lock the rope and stop the fall of the climber. Occasionally, a belayer will panic and actually grab the auto-locking belay device tighter, rather than releasing the device, when a climber falls while the belayer has overridden the normal function of the auto-locking belay device. In this situation, the instinct of the belayer is to grab harder, as if that would stop the rope, when in fact that action does not allow the override function to be cancelled and therefore allows the rope to continue to pass through the belay device. The result can be harmful or fatal to the climber since the fall is not stopped.

The subject Safe Auto-Locking Belay Override Mechanism solves a very dangerous problem of auto-locking belay devices by canceling the override function even

if a belayer panics, as described above, during the fall of a climber. A novel and unobvious aspect of the invention relies on the fact that the belayer actually grabs the device tighter when he panics. The subject invention therefore consists of an override mechanism that responds differently to different force levels from the belayer, and to three force levels in particular. If there is minimal or no force exerted on the Safe Auto-Locking Belay Override Mechanism by the belayer, the auto-locking belay device's normal function will not be overridden and the auto-locking belay device can therefore lock the rope if the rope forces are sufficient to lock it, such as during a fall of a climber. If there is an intermediate amount of force exerted on the Safe Auto-Locking Belay Override Mechanism by the belayer, such as during the times when a belayer needs to feed rope through the belay device, the normal function of the auto-locking belay device will be overridden and therefore the rope will not be locked against movement through the auto-locking belay device. If, however, there is a high amount of force exerted on the Safe Auto-Locking Belay Override Mechanism by the belayer, such as when the belayer panics, the override function will be cancelled thereby allowing the auto-locking belay device to function normally and to lock the rope if the rope forces are sufficient such as during a fall of a climber.

Although there are many different styles of auto-locking belay devices, they all function by locking the rope against further movement if the rope exerts sufficient force on the device such as would occur when a climber falls, and they all have a means to override this normal function such that rope can be fed quickly through the device by the belayer when it is advantageous to do so. Much of the relevant prior art deals with descenders, devices which function like auto-locking belay devices but with the primary purpose of allowing a person to descend a rope. Examples of the prior art include U.S. Patents 5,054,577 to Petzl et. al., 5,076,400 to Petzl et. al., 5,360,083 to Hede, 5,577,576 to Petzl et. al., 5,597,052 to Rogleja, 5,850,893 to Hede, and 6,029,777 to Rogleja. A very popular commercially available auto-locking belay apparatus is the GRIGRI made by the Petzl company of Crolles, France. None of the aforementioned examples of the prior art disclose, teach, or illustrate the unique function and use of the subject invention.

The potential safety problem with the override mechanism of auto-locking belay devices of the prior art is well known by those experienced in the art. Prior to the subject invention, attempts to mitigate this problem have focused on the physical interaction between the rope and the belay device, rather than on the realization that the belayer actually exerts greater force on the override mechanism when he panics while the override mechanism is activated. For example, the GriGri contains a locking cam that is biased against movement by a spring. The purpose of the locking cam is to lock the rope if sufficient rope forces are present to rotate the cam. The purpose of the spring, that biases the cam against movement, is to allow the belayer to feed rope through the device without having to override the normal function of the device. Although this works during cases when the belayer can feed the rope slowly and steadily through the device, it does not work in the case that the belayer needs to feed rope quickly through the device. If a belayer needs to feed rope quickly through the GriGri, he must still override the normal function of the GriGri in order to do so.

The concept of the subject Safe Auto-Locking Belay Override Mechanism, which responds differently to three different belayer force levels, can be applied to render any of these prior art auto-locking belay devices much safer; but the particular embodiment of the invention will be different depending on the design of the auto-locking belay device for which it is intended. The particular embodiments of the Safe Auto-Locking Belay Override Mechanism described and illustrated herein are for an auto-locking belay device which operates based on a rotating locking cam, such as the device illustrated in US patent #5,076,400 to Petzl et al.. The subject invention is intended, however, to cover all embodiments which utilize the novel concepts described above, not just the particular embodiments illustrated.

SUMMARY

The essence of the present invention is a safer mechanism to override the normal function of an auto-locking belay device. The mechanism makes use of the fact that a

belayer actually exerts greater force on the override mechanism of an auto-locking belay device if the belayer panics, such as sometimes occurs during the fall of a climber.

OBJECTS AND ADVANTAGES

In view of the foregoing, it is a primary object of the present invention to provide a safety auto-locking belay device that will lock a rope against movement if a belayer panics after having overridden the normal function of the auto-locking belay device.

Another object is that Safe Auto-Locking Belay Override Mechanism of the subject invention does not add significantly to the size or weight of an auto-locking belay device.

Still another object is that the Safe Auto-Locking Belay Mechanism is simple to use.

These and other objects of the subject invention will become apparent to those familiar with the different types of auto-locking belay devices when reviewing the following detailed description, showing novel construction, combination, and elements as herein described, and more particularly defined by the claims, it being understood that changes in the embodiments to the herein disclosed invention are meant to be included as coming within the scope of the claims, except insofar as they may be precluded by the prior art.

DRAWING FIGURES

FIG. 1 presents both front (6) and side (8) views of a first embodiment of the subject invention including certain other components of an auto-locking belay device to which the subject invention is attached.

FIG. 2 presents an exploded view of the components of a Second Embodiment Safe Auto-Locking Belay Override Mechanism (60).

FIG. 3 illustrates left front (62) and right front (64) views of the Second Embodiment Auto-Locking Belay Override Mechanism (60).

REFERENCE NUMERALS IN DRAWINGS

6	Front View - First Embodiment
8	Side View - First Embodiment
10	Axle
12	Rotating Locking Cam
14	Axle Passage Opening
16	Face Plate
18	Axis Of Rotation
20	Extension Arm
22	Axle Extension
24	Safe Auto-Locking Belay Override Mechanism
26	Force Isolation Plate
28	Lever
30	Hinge
32	Spring
34	Lever Top Leg
36	Lever Side Leg
38	Outside Surface
40	Second Embodiment Axle
42	Axle Key
44	Second Embodiment Locking Cam
46	Cam Key Slot
48	Opening
50	Wall
52	Axle Stop
54	Arm

56 Spring

58 Pressure Plate

60 Second Embodiment Auto-Locking Belay Override Mechanism

62 Left Front

64 Right Front

DESCRIPTION AND OPERATION - FIRST EMBODIMENT

FIG. 1 - Both a Front View (6) and Side View (8) of a first embodiment of the subject invention are shown. In an auto-locking belay device (not entirely shown), an Axle (10) extends outward from a Rotating Locking Cam (12), through an Axle Passage Opening (14) in a Face Plate (16) of the auto-locking belay device (not entirely shown). The Axle (10) is fixedly attached to the Rotating Locking Cam (12) and forms the Axis Of Rotation (18) around which the Rotating Locking Cam (12) can rotate. An Extension Arm (20) is fixedly attached to the Axle (10) at a point on the opposite side of the Face Plate (16) relative to the Rotating Locking Cam (12). An Axle Extension (22) is fixedly attached to an end of the Axle (10) at the Extension Arm (20). A Safe Auto-Locking Belay Override Mechanism (24) comprises the Axle Extension (22), a Force Isolation Plate (26), a Lever (28), a Hinge (30), and a Spring (32). The Force Isolation Plate (26) is pivotally attached to the Axle Extension (22). The Force Isolation Plate (26) can rotate around the Axle Extension (22) even if the Axle (10) is not rotating. The Lever (28) is attached to the Force Isolation Plate (26) by way of the Hinge (30). The Lever (28) has an "L" shape and is force loaded by the Spring (32) such that in its normal position, a Lever Top Leg (34) is positioned directly above the Extension Arm (20) and a Lever Side Leg (36) is positioned near and parallel to an Outside Surface (38) of the Force Isolation Plate (26). The Spring (32) is tensioned such that a mild force exerted on the Lever Side Leg (36) at a point below the Hinge (30) in the direction of the Force Isolation Plate (26) will not result in significant movement of the Lever (28), but a relatively heavy force exerted on the Lever Side Leg (36) at a point below the Hinge (30) will cause the Lever

(28) to rotate on the Hinge (30), thereby causing the Lever Top Leg (34) to move to a position which is not directly above the Extension Arm (20).

The Rotating Locking Cam (12) is the mechanism within the auto-locking belay device (not entirely shown) that rotates to lock the rope (not shown). Since the Extension Arm (20) is fixedly attached to the Axle (10) which, in turn, is fixedly attached to the Rotating Locking Cam (12), rotation of the Rotating Locking Cam (12) causes the Extension Arm (20) to rotate with along with the Axle (10). Consequently, blocking the movement of the Extension Arm (20) will prevent the Rotating Locking Cam (12) from rotating, thereby overriding the normal function of the auto-locking belay device and preventing the locking of the rope (not shown).

In operation, a belayer should only hold the auto-locking belay device (not entirely shown) when he needs to feed out rope to a climber. When a belayer does need to feed out rope, he must grab the auto locking belay device (not entirely shown) such that his fingers exert mild pressure on the Lever Side Leg (36) at a point below the Hinge (30) and the auto-locking belay device (not entirely shown) rests in his palm positioned such that no part of his hand blocks the rotation path of the Extension Arm (20).

If a climber falls when the belayer is not feeding rope and therefore is not holding the auto-locking belay device (not entirely shown), the Rotating Locking Cam (12) will rotate to lock the rope (not shown). This will cause the Extension Arm (20) to rotate, which will exert force on the Lever Top Leg (34) thereby causing the Force Isolation Plate (26) to also rotate.

If a belayer grabs the auto-locking belay device (not entirely shown) properly, as discussed above, in order to feed rope, the mild pressure exerted on the Lever Side Leg (36) by his fingers will be sufficient to prevent the Force Isolation Plate (26) from rotating, but will not be sufficient to compress the Spring (32). Therefore the Lever Top Leg (34) will remain positioned above the Extension Arm (20) preventing movement of the Extension Arm (20) thus preventing rotation of the Rotating Locking Cam (12) thereby overriding the normal function of the auto-locking belay device and preventing

locking of the rope. In this manner, the belayer can rapidly feed rope (not shown) through the auto-locking belay device (not entirely shown).

If a climber falls when the belayer has grabbed the auto-locking belay device (not entirely shown) in order to feed out rope, the belayer can simply let go of the auto locking belay device (not entirely shown) and it will lock the rope (not shown) as described previously. If, however, the belayer panics when the climber falls and tightens his grasp on the Safe Auto-Locking Belay Override Mechanism (24), the Safe Auto-Locking Belay Override Mechanism (24) will function in a manner that does not override the normal function of the auto-locking belay device, thus allowing the Rotating Locking Cam (12) to lock the rope. Specifically, the panic reaction of the belayer will cause him to grasp the Safe Auto-Locking Belay Override Mechanism (24) more firmly. This firmer grasp by the belayer will cause the Lever Side Leg (36) to compress the Spring (32) causing the Lever (28) to rotate around the Hinge (30), thereby causing the Lever Top Leg (34) to move out of its position above the Extension Arm (20). With the Extension Arm (20) no longer blocked by the Lever Top Leg (34), the Extension Arm (20), Axle (10) and Rotating Cam (12) will all rotate thus locking the rope (not shown).

DESCRIPTION AND OPERATION - SECOND EMBODIMENT

FIG. 2 - A Second Embodiment Axle (40) contains an Axle Key (42). A Second Embodiment Locking Cam (44) contains a Cam Key Slot (46) shaped such that the Axle Key (42) fits smoothly within the Cam Key Slot (46). The Second Embodiment Locking Cam (44) is positioned on the Second Embodiment Axle (40). When the Axle Key (42) is engaged in the Cam Key Slot (46), both the Second Embodiment Axle (40) and the Second Embodiment Locking Cam (44) move (rotate) together. When the Axle Key (42) is not engaged in the Cam Key Slot (46), the Second Embodiment Locking Cam (44) can rotate around the Second Embodiment Axle (40) independent from any rotation of the Second Embodiment Axle (40). A portion of the Second Embodiment Axle (40) passes through an Opening (48) in a Wall (50) of the auto-locking belay device (not entirely

shown). The Second Embodiment Axle (40) contains an Axle Stop (52) that serves to prevent further passage of the Second Embodiment Axle (40) through the Opening (48) in the Wall (50). An end of the Second Embodiment Axle (40) is firmly attached to an Arm (54) such that the Arm (54) rotates up or down whenever the Second Embodiment Axle (40) rotates. A portion of the Second Embodiment Axle (40) passes through a Spring (56). The Spring (56) is positioned between the Wall (50) and the Arm (54). In normal configuration, the Spring (56) is compressed slightly such that it pushes outward on the Arm (54) thus acting to hold the Axle Key (42) in the Cam Key Slot (46). The Second Embodiment Axle (40) and the Second Embodiment Locking Cam (44) are dimensioned such that the Axle Key (42) is fully engaged in the Cam Key Slot (46) when the Axle Stop (52) is contacting the Wall (50). The outer portion of the Arm (54) contains a Pressure Plate (58). Although certain components, such as the Second Embodiment Locking Cam (44), perform multiple roles within the auto-locking belay device (not entirely shown), all numbered components mentioned previously comprise the Second Embodiment Auto-Locking Belay Override Mechanism (60).

FIG. 3 - Presents Left Front (62) and Right Front (64) views of the components comprising the Second Embodiment Auto-Locking Belay Override Mechanism (60).

In normal operation, the Axle Key (42) is engaged in the Cam Key Slot (46). If a climber falls and the belayer is not blocking the Arm (54), the Second Embodiment Locking Cam (44) will rotate, along with the Arm (54), and the auto-locking belay device (not entirely shown) will function normally thus locking the rope against further movement. By exerting intermediate inward pressure on the Pressure Plate (58), the belayer can feed out rope quickly. The intermediate inward pressure on the Pressure Plate (58) keeps the Arm (54) from rotating and thus keeps the Second Embodiment Locking Cam (44) from rotating thus overriding the normal function of the auto-locking belay device (not entirely shown). If the belayer exerts significant inward pressure on the Pressure Plate (58), such as in a case when the belayer panics, the Arm (54) will move inward and the Spring (56) will further compress, thus causing the Axle Key (42) to disengage from the Cam Key Slot (46). The Second Embodiment Locking Cam (44) will

then rotate independently from the Second Embodiment Axle (40) and the auto-locking belay device (not entirely shown) will lock. After such an event, the Arm (54) can simply be rotated upward to reengage the Axle Key (42) in the Cam Key Slot (46), in order to then lower the climber.

CONCLUSION, RAMIFICATIONS, AND SCOPE

Thus the reader will see that the Safe Auto-Belay Override Mechanism of the subject invention yields a far safer auto-locking belay device relative to the prior art.

While the above descriptions contain many specificities, these should not be construed as limitations on the scope of the invention, but rather as exemplification of two embodiments thereof. The novelty of the present invention lies not within any particular mechanical embodiment, but within the recognition that a belayer tends to grip a belay device tighter when he panics and this tighter grip can be utilized in a way that enhances the safety of an auto-locking belay device. Accordingly, the scope of the invention should be determined not by the particular embodiments illustrated, but by the appended claims and their legal equivalents.